

**Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBAJINAGAR.**



CIRCULAR NO.SU/ Sci./College/NEP-2020/104/2024

It is hereby inform to all concerned that, In continuation circular No.SU./Revised B.Sc./NEP/72/2024/25588-96 dated 29.04.2024, the revised syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technolgy, the Academic Council at its meeting held on 08 April 2024 has accepted **the following Revised B.Sc. Course Structure & Curriculum** as per direction by the State Government dated on 13 March 2024 under the Faculty of Science & Technology (as per National Education Policy – 2020) run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	Physics	Ist and IInd semester
2	Instrumentation Practice	Ist and IInd semester
3	Electronics	Ist and IInd semester
4	Mathematics	Ist and IInd semester
5	Industrial Chemistry	Ist and IInd semester
6	Agrochemical Fertilizer	Ist and IInd semester
7	Horticulture	Ist and IInd semester
8	Biochemistry	Ist and IInd semester
9	Botany	Ist and IInd semester
10	Zoology	Ist and IInd semester
11	Biotechnology	Ist and IInd semester
12	bioinformatics	Ist and IInd semester
13	Microbiology	Ist and IInd semester
14	Dairy Science & TEchnology	Ist and IInd semester
15	Statistics	Ist and IInd semester
16	computer Science	Ist and IInd semester
17	Geology	Ist and IInd semester
18	Chemistry	Ist and IInd semester
19	Analytical Chemistry	Ist and IInd semester
20.	Polymer Chemistry	Ist and IInd semester
21.	Environmental Science	Ist and IInd semester
22.	Fishery Science	Ist and IInd semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajanagar
-431 004.
REF.NO. SU/SCI./2024/27128-35
Date:-27.05.2024.

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**Deputy Registrar,
Academic Section.**

Copy forwarded with compliments to :-

- 1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajanagar.
- 6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.

Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajinagar- 431001



B.Sc. Degree Programme

(Three Year / Four Years (Hons) / Four Years (Hons with Research))

Course Structure and Syllabus of B. Sc. 1st year

(Revised)

(AS PER NEP-2020)

Subject (Major): CHEMISTRY

Effective from 2024-25

PREFACE

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Science (B. Sc.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century.

At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Science (B. Sc.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight.

Furthermore, the curriculum is designed to promote experiential learning, research, and hands-on exploration, recognizing the importance of practical engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in practical settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery.

Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Science (B. Sc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Science (B. Sc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world.

As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Science (B. Sc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.

Structure of B. Sc. (Three / Four Years Honours / Honours with Research Degree) Programme with Multiple Entry and Exit Options

Subject (Major): Chemistry

BSc First Year: 1st Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory	DSC-1	Fundamentals of Chemistry-I	2		2		2+2 = 4
	DSC-2	Lab course -1		4		2	
Major (Core) M2 Mandatory	DSC-1		2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Major (Core) M3 Mandatory	DSC-1		2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	GE/OE -1	It should be chosen compulsorily from the faculty other than that of Major	2		2		2
SEC (Skill Enhancement Courses) (Choose any one from pool of courses)	SEC-1	A. Water Treatment and Analysis B. Stoichiometry-I	1		1		2
	SEC-2	Practicals based on SEC-1 A. Water Treatment and Analysis B. Stoichiometry-I		2		1	
AEC, VEC, IKS	AEC-1	English (Common for all the faculty)	2		2		2+2 =4
	IKS-1	Choose any one from pool of courses	2		2		
OJT/ FP/CEP/CC/RP	CC-1	Health and Wellness (Common for all the faculty)		4		2	2
			13	18	13	09	22

GE/OE-1 : Herbal Chemistry -I
(science and technology)

(2 credit theory course for the students of faculty other than

BSc First Year: 2nd Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory	DSC-3	Fundamentals of Chemistry-2	2		2		2+2 = 4
	DSC-4	Lab course -2		4		2	
Major (Core) M2 Mandatory	DSC-3		2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Major (Core) M3 Mandatory	DSC-3		2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	GE/O E-2	It should be chosen compulsorily from the faculty other than that of Major	2		2		2
VSC (Vocational Skill Courses) (Choose any one from pool of courses)	VSC-1	A. Cosmetics and perfumery B. Soap and Detergent	1		1		2
	VSC-2	Practicals based on VSC- A. Cosmetics and perfumery B. Soap and Detergent		2		1	
AEC, VEC, IKS	AEC- 1	English (Common for all the faculty)	2		2		2+2 =4
	VEC- 1	Constitution of India (Common for all the faculty)	2		2		
OJT/ FP/CEP/CC/RP	CC-2	Yoga Education / Sports and Fitness (Common for all the faculty)		4		2	2
			13	18	13	09	22
Exit Option : Award of UG Certificate in 3 Majors with 44 credits and an additional 4 credits of core NSQF course / Internship OR continue with Major and Minor							

GE/OE-2 : **Herbal Chemistry -II**
(science and technology)

(2 credit theory course for the students of faculty other than

Students will have to choose any three subjects as a **Major 1, Major 2, Major 3**, from Basket 1 under the Faculty of Science and Technology.

Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year. Students will have to select / declare choice of one subject as a **major subject** in the beginning of second year **out of three major options M1, M2 and M3 (which were opted in the first year).**

Detailed Illustration of Courses included in 1st and 2nd semester:

- 1) **Major (Core)** subject are mandatory.

DSC-1 : This is a 2 credit theory course corresponding to Major (core) subject

DSC-2 : This is a 2 credit practical course based on DSC-1

DSC-3 : This is a 2 credit theory course corresponding to Major (core) subject

DSC-4 : This is a 2 credit practical course based on DSC-3

- 2) **Generic / Open Elective (GE/OE):** (Needs to be chosen (any two) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

GE/OE -1 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

GE/OE -2 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

- 3) **SEC (Skill Enhancement Courses) :** Choose any one from pool of courses. These courses needs to be designed to enhance the technical skills of the students in specific area.

SEC-1 : This is a 1 credit theory course to enhance the technical skills of the students in specific area.

SEC-2 : This is a 1 credit practical course based on SEC-1.

- 4) **VSC (Vocational Skill Courses) :** Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

VSC-1 : This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

VSC-2 : This is a 1 credit practical course based on VSC-1

- 5) **AEC (Ability Enhancement courses):** The focus of these courses should be based on linguistic and communication skills.

AEC-1 : English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

AEC-2 : English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

- 6) **IKS (Indian Knowledge System)** : The courses related to traditional and ancient culture of India will be included in this section. The respective college will have to choose one of the courses from the pool of courses designed by the University.

IKS-1 : To be chosen from the pool of courses designed by the University

This is a 2 credit theory course based on Indian Knowledge System. It will be common for all the faculty

- 7) **VEC (Value Education Courses)**: The courses such as understanding India, Environmental Science / Education, Digital and Technological solutions etc will be part of Value Education Courses.

VEC-1 : Constitution of India

This is a 2 credit theory course based on value education. It will be common for all the faculty

- 8) **CC (Curricular Courses)**: The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Performing Arts.

CC-1 : Health and Wellness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

CC-2 : Yoga education / Sports and Fitness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

General Guidelines for Course Selection

- 1) The Major subject is the discipline or course of main focus, bachelors degree shall be awarded in that discipline / subject.
- 2) Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from **Basket 1** under the Faculty of Science and Technology (based on the available options in the respective college).
- 3) Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year.
- 4) In the beginning of second year, students will have to select / declare choice of **one major subject** and **one minor subject** from three major options **M1, M2 and M3 (which were opted in the first year)**
- 5) Once the students finalize their **Major Subject** and **Minor Subject** in the beginning of the second year of the programme, they shall pursue their further education in that particular subject as their **Major and Minor** subjects. Therefore, from second year onwards curriculum of the Major and Minor subjects shall be different.
- 6) Students are required to select **Minor subject** from **other discipline of the same faculty**
- 7) Students are required to select **Generic /Open Elective** (vertical 3 in the credit framework) **compulsorily from the faculty different than that of their Major / Minor subjects.**
- 8) Vocational Skill Courses and Skill Enhancement Courses (VSC and SEC) shall be related to the Major subject
- 9) Curriculum of Ability Enhancement Courses (AEC), Value Education Courses (VEC), Indian Knowledge System (IKS), and Co-curricular Courses (CC) will be provided by the University separately.

Programme Educational Objectives (PEOs) :

Programme Educational Objectives (PEOs) for the Bachelor of Science Curriculum under the National Education Policy 2020:

1. **Mastery of Discipline-Specific Knowledge:** Graduates of the Bachelor of Science program will demonstrate a deep understanding of fundamental principles, theories, and methodologies in their chosen scientific discipline, enabling them to analyze complex problems, propose innovative solutions, and contribute to advancements in their field.
2. **Interdisciplinary Proficiency:** Graduates will possess the ability to integrate knowledge and skills from multiple scientific disciplines, fostering a holistic approach to problem-solving and innovation. They will be equipped to address multifaceted challenges by drawing upon diverse perspectives and methodologies.
3. **Critical Thinking and Analytical Skills:** Graduates will develop strong critical thinking abilities, enabling them to evaluate information rigorously, analyze data effectively, and make informed decisions based on evidence. They will demonstrate proficiency in applying logical reasoning and scientific methods to solve problems and generate new knowledge.
4. **Leadership and Innovation:** Graduates will demonstrate leadership qualities and entrepreneurial mindset, capable of initiating and driving positive change in their organizations and communities. They will exhibit creativity, resilience, and adaptability, harnessing innovation to address complex challenges and seize opportunities for growth and advancement.
5. **Global Citizenship and Cultural Sensitivity:** Graduates will possess a global perspective and cultural sensitivity, recognizing the interconnectedness of diverse communities and the importance of collaboration across borders. They will engage in cross-cultural dialogue, embrace diversity, and contribute to the advancement of knowledge and understanding on a global scale.

These Programme Educational Objectives serve as guiding principles for the Bachelor of Science curriculum, reflecting our commitment to nurturing well-rounded graduates who are prepared to excel in their careers, contribute to society, and lead meaningful lives in a rapidly changing world.

Programme Outcomes (POs) :

The National Education Policy (NEP) 2020 for India emphasizes several key aspects for Bachelor of Science (B.Sc.) programs, aiming to produce graduates who are not only well-versed in their respective disciplines but also equipped with skills necessary for holistic development and employability. While specific program outcomes may vary between institutions and disciplines within B.Sc. programs, here are some common outcomes aligned with NEP 2020:

- **PO1. The citizenship and society:** Apply broad understanding of ethical and professional skill in science subjects in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.
- **PO2. Environment and sustainability:** Apply broad understanding of impact of science subjects in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.
- **PO3. Ethics:** Apply ability to develop sustainable practical solutions for science subject related problems within positive professional and ethical boundaries.
- **PO4. Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.
- **PO5. Communication:** Communicate effectively on complex science subject related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO6. Project management and finance:** Demonstrate knowledge and understanding of the first principles of science and apply these to one's own work as a member and leader in a team, to complete project in any environment.
- **PO7. Life-long learning:** Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

These program outcomes align with the broader goals of NEP 2020 to transform higher education in India and prepare students for the challenges and opportunities of the 21st century. Board of Studies designing B.Sc. curricula are encouraged to incorporate these outcomes into their program objectives and learning outcomes.

Programme Specific Outcomes (PSOs):

PSO1; Core competency: The chemistry graduates will know the fundamental concepts of chemistry and applied chemistry. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.

PSO2; Communication skills: Chemistry graduates will possess minimum standards of communication skills expected of a Chemistry graduate in the country. They are expected to read and understand the documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience.

PSO3; Critical thinking: Chemistry graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.

PSO4; Psychological skills: Chemistry Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various sociocultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.

PSO5; Problem-solving: Chemistry Graduates will be equipped with problem-solving philosophical approaches that are pertinent across the disciplines.

PSO6; Analytical reasoning: Chemistry Graduates acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.

PSO7; Research-skills: Chemistry Graduates will be keenly observant about what is going on in the natural surroundings to awake their curiosity. Chemistry Graduates are expected to design a scientific experiment through statistical hypothesis testing and other *a priori* reasoning including logical deduction.

PSO8; Teamwork: Chemistry Graduates will be team players, with productive cooperations involving members from diverse socio-cultural backgrounds.

PSO9; Digital Literacy: Chemistry Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning. Chemistry Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.

PSO10; Moral and ethical awareness: Chemistry Graduates will be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.

PSO11; Leadership readiness: Chemistry Graduates are expected to be familiar with decision making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

Semester I

DSC-1 : (Title of Paper) FUNDAMENTALS OF CHEMISTRY-1

Total Credits : 02

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- i) To develop critical thinking about the Atomic Structure.
- ii) To understand the structure of an atom and electron distribution in an atom.
- iii) To understand variation in periodic properties.
- iv) To understand the basic concept of organic reaction mechanism.
- v) To understand reaction intermediate involved in organic reactions
- vi) Students will learn Fundamentals of Thermodynamics
- vii) To understand different laws of thermodynamics

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) Write the electronic configurations of the elements
- ii) Understand the changes in periodic properties in modern periodic table
- iii) Understand the different types of electron displacement in a molecule
- iv) Differentiate between inductive, electromeric, resonance, and mesomeric effects.
- v) Understand the methods of formation, structure and properties of the intermediate.
- vi) Understand the basic concepts and different laws of thermodynamics and thermochemistry
- vii) The concept of chemical equilibrium

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Atomic Structure and Periodicity of Elements Bohr's theory and its limitations. Idea of de-Broglie matter waves. Heisenberg uncertainty principle. Quantum numbers and its types. Significance of quantum numbers. Shapes of s, p and d atomic orbitals, nodal planes. Rules for filling electrons rules in various orbitals: i) Aufbau's principle ii) Hund's rule of maximum multiplicity iii) Pauli's exclusion principle Electronic configuration of elements from Hydrogen to Zinc. Stability of empty, half-filled and completely filled orbitals Definition and trends in Periodic table of the following	10 Hrs

	properties: i) atomic radii and ionic radii ii) ionization energy iii) electron affinity iv) electronegativity, Factors affecting ionization energy. Pauling's and Mullikan's scale of electronegativity	
II	<p>A) Fundamentals of Organic Reaction mechanism</p> <p>Electronic Displacements: Inductive Effect, Electrometric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: formation, structure, reactivity and stability of Carbocations, Carbanions, free radicals Carbene and Nitrene. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.</p>	10 Hrs
III	<p>Thermodynamics</p> <p>Basic concepts of thermodynamics: system, surrounding, boundary. Types of systems. State & path functions. Thermodynamic processes. Intensive & Extensive properties. First law of thermodynamics. Spontaneous & nonspontaneous processes. Statements of second law of thermodynamics. Carnot's cycle and its efficiency. Entropy, physical significance of entropy. Third law of thermodynamics. Calculation of absolute entropies of substances.</p> <p>Thermochemistry</p> <p>Concept of standard state, standard enthalpy of formation. Hess's law of constant heat summation and its applications. Bond dissociation energy and its calculations from thermochemical data. Temperature dependence of enthalpy- Kirchoff's equation.</p> <p>Chemical Equilibrium:</p> <p>Free energy change in chemical reactions. Thermodynamic derivation of the law of chemical equilibrium. Relation between K_p, K_c and K_x for reactions involving ideal gases. Le Chatelier's principle.</p>	10 Hrs
Text / Reference Books:		
Unit I		

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
5. Puri, Sharma, Kalia. Principles of Inorganic Chemistry
6. Madan R. L. Chemistry for Degree Students (B . Sc. First year), S. Chand Publications

Unit II

1. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
4. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
5. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
6. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
7. Stanley Pine, Organic Chemistry, 5th edition.
8. Mukharjee, Singh and Kapoor, Organic Chemistry Vol. I, II and III -Wiley Eastern.
9. S.K. Ghosh, Organic Chemistry.
10. S.M. Mukharjee and S.P. Singh, Reaction Mechanism in Organic Chemistry.
11. P.S. Kalsi, Stereochemistry and mechanism through solved problems.
12. P S Kalsi, Organic reactions and their mechanism , New age.
13. Grossman, Robert B, The Art of Writing Reasonable Organic Reaction Mechanism
14. Raj K Bansal Organic chemistry
15. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000
16. P.S. Kalsi , Text book of Organic Chemistry , Macmillan India Ltd., 1999, Delhi.

Unit III

1. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing House, 44th Edition
2. Gurdeep Raj, Advanced Physical Chemistry GOEL Publishing House, 6th Edition
3. Bahl , Tuli and Bahl, Essentials of Physical Chemistry,

4. Soni and Dharmarha, Text Book of Physical Chemistry,
5. H J Arnkar, Essentials of Nuclear Chemistry, New Age, 4th edition.
6. F. Daniel, Mathematical preparation of Physical Chemistry :,Mc-Graw Hill Book Company Ltd.
7. S. Glasstone and D. Lewis, Elements of Physical Chemistry : (D.Van Nostrand Co.Inc)
8. W. J. Moore, Physical Chemistry : (Orient Longman)
9. Maron Prutton, Principles of Physical Chemistry :
10. B. H. Mahan, University Chemistry: (Addison - Wiseley Publ. Co.)

DSC-2 : (Title of Paper) Lab Course -1

Total Credits : 02

Total Contact Hours : 60 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- i) To introduce glassware and instruments used in a Chemistry laboratory.
- ii) To understand the importance of calibration of glassware and instruments in tune with concepts of precision and accuracy.
- iii) To develop awareness about safety measures for handling chemicals
- iv) Develop proficiency in fundamental chemical laboratory techniques.
- v) To develop the skill of preparation of solution of different concentration using stoichiometry
- vi) Follow established SOPs for various chemical experiments

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) To consistently follow established SOPs for various chemical experiments.
- ii) To prepare solution of desired concentration..
- iii) To maintain accurate and thorough records of experimental data, and analyze results to draw meaningful conclusions.
- iv) To apply critical thinking skills to identify and address challenges that may arise during experiments, showcasing the ability to troubleshoot and optimize procedures.
- v) To gain insights into how chemical lab practices are applied in professional research or industrial settings, preparing them for future careers in diverse scientific and industrial fields.
- vi) Students will demonstrate ethical conduct in all aspects of laboratory work, emphasizing integrity, responsibility, and professionalism

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	<ol style="list-style-type: none">1. Recognition of Safety symbols, chemical packings and instruments together with the conception of MSDS.2. Introduction to pictogram of chemical used. (Acids, Bases, Solvents and Salts)3. Material Safety Data Sheets with reference to hazardous chemicals like $K_2Cr_2O_7$, Benzene, Cadmium nitrate, β-naphthol, CCl_4 and Mercury.4. Precautions in handling of hazardous substances like conc. acids, ammonia, organic solvents like ether and alcohol.5. Demonstration of first aid measures for chemical accidents.6. Demonstration of preventive measures for chemical spills.7. Demonstration of first aid measures, when chemical materials entered in human body through Eye, Mouth and Skin <ol style="list-style-type: none">1. Calibration of Burette2. Calibration of Pipette	20 Hrs

	3. Calibration of Standard Measuring Flask 4. Calibration of Thermometer (Demonstration)	
II	1. Preparation of standard solution of oxalic acid by weighing and calculation of concentrations in terms of strength, normality, molarity and molality. 2. Preparation of standard solution of a base (sodium carbonate) by weighing and calculation of concentrations in terms of strength, normality, molarity and molality. 3. Prepare 1 % NaOH solution and find its exact normality using standard oxalic acid solution. 4. Determine molarity and strength of unknown hydrochloric acid with the help of standard 0.05M sodium carbonate solution. 5. Standardization of given NaOH solutions using standard 0.02 N Na ₂ CO ₃ 6. Prepare 0.1 N H ₂ SO ₄ solution and find out its exact normality using NaOH as an intermediate solution and 0.1 N Oxalic acid as standard solution	20 Hrs
III	1. Determination of heat capacity of calorimeter for different volumes. 2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide. 3. Determination of enthalpy of ionization of acetic acid. 4. Determination of integral enthalpy of solution of salts (KNO ₃ , NH ₄ Cl). 5. Determination of enthalpy of hydration of copper sulphate.	20 Hrs

Text / Reference Books:

- 1) F.G. Mann, B.C. Saunders, Practical Organic Chemistry, Orient Longman.
- 2) V.K. Ahluwalia and Sunita Dhingra, Comparative Practical Organic Chemistry (Qualitative Analysis), Orient Longman.
- 3) V.K. Ahluwalia and Renu Agrawal, Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by, Orient Longman.
- 4) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- 5) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
- 6) Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012
- 7) Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.
- 8) Vogel-A text book of qualitative inorganic analysis.
- 9) O P Pandey, D. N, Practical Chemistry (for B.Sc. I, II and III year students) – Bajpai and
- 10) Kolthoff and Sandell-Text book of qualitative inorganic analysis
- 11) Ahluwalia, V.K.; Dhingra, S. (2004), Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.
- 12) Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012), Vogel's Textbook of Practical Organic Chemistry, Pearson.
- 13) Leonard, J.; Lygo, B.; Procter, G. Advanced Practical Organic Chemistry, CRC Press.
- 14) Palit and De, Practical Physical Chemistry:.
- 15) Yadav, Practical Physical Chemistry:.
- 16) Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
- 17) Gurdeep Raj, Advanced Practical Inorganic Chemistry, Goel Publishing House, Meerut.
- 18) S. W. Rajbhoj and Dr. T. K. Chondekar, Systematic Practical Physical Chemistry by Prof. Anjali Publication, Aurangabad

Web resources:

1. <https://vlab.amrita.edu/?sub=2>
2. <https://chemcollective.org/vlabs>
3. <https://chem.libretexts.org/>
4. https://en.wikipedia.org/wiki/Laboratory_glassware#:~:text=Laboratory%20glassware%20refers%20to%20a,%2C%20biology%2C%20and%20analytical%20laboratories.
1. <https://brilliant.org/wiki/inductive-effect-electromeric-effect-resonance/>
2. <https://sciencing.com/glassware-apparatus-uses-7445911.html>
3. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/Misc/COMMON_LABORATORY_TECHNIQUES
4. <https://www.youtube.com/watch?v=Q47hTa1KvN0&t=871>
5. https://chem.libretexts.org/Ancillary_Materials/Demos_Techniques_and_Experiments/General_Lab_Techniques
6. <https://ucblucash.edu/content/dam/refresh/blucash-62/documents/academics/academic-departments/chemistry/LabSafetyRules.pdf>

SEC-1 A : (TITLE OF PAPER) - Water Treatment and Analysis

Total Credits : 01 (Theory paper)

Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

1

- i) To know the sources of water pollutants
- ii) To aware about the properties of water
- iii) Know the difference between industrial effluent and municipal waste
- iv) Know the quality of drinking water and irrigation water

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) Resources and properties of water
- ii) Understand the different pollutants
- iii) Understand treatment of domestic and industrial water
- iv) Understand the sources of water pollution

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Study of Water a. Hydrosphere- Water resources. b. Properties of water- color, odor, turbidity, total salt content, total suspended water. b. Water pollution- Definition of water pollution, types of water pollutants, sources of water pollutants, trace element in water, water quality parameters and standards d. Purification of water- Treatment of domestic and industrial water e. Sources of Pollution - Physical, Chemical, Organic & Biological properties of Industrial Wastewater, Difference between industrial; municipal waste waters, Effects of industrial effluents on sewers and Natural water Bodies. Chemistry of Water a. Water Quality Parameters and Standards- Quality of drinking water, Quality of irrigation water, COD, BOD, b. Water Microbiology - TOCE-coli and total bacteria. c. Sewage analysis	15 Hrs
I. D.R. Khanna, R. Bhutiani, Laboratory Mannual of Water and Wastewater Analysis, Daya Publishing House, Delhi, 2008 2. R.K. Trivedy Chemical and Biological Methods for Water Pollution Studies, , P.K.Goel,		

Oriental Printing Press, Aligarh, 1986

SEC-2 A : (TITLE OF PAPER) - Water Treatment and Analysis

Total Credits : 01 (Practical paper)

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

1

- i) To know the sources of water pollutants
- ii) To aware about the properties of water
- iii) Know the difference between industrial effluent and municipal waste
- iv) Know the quality of drinking water and irrigation water

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) Resources and properties of water
- ii) Understand the different pollutants
- iii) Understand treatment of domestic and industrial water
- iv) Understand the sources of water pollution
- v) Carryout experiment for determination of water quality parameters

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Collection of water samples (Field work) 2. Determination of total hardness of water 3. Determination of alkalinity of water 4. Determination of pH of water 5. Determination of conductivity of water 6. Determination of TDS in water. 7. Determination of Dissolved Oxygen (DO) in water. 8. Determination of BOD of water 9. Determination of COD of water	30 Hrs

1. D.R. Khanna, R. Bhutiani, Laboratory Manual of Water and Wastewater Analysis, Daya Publishing House, Delhi, 2008

2. R.K. Trivedy Chemical and Biological Methods for Water Pollution Studies, , P.K.Goel, Oriental Printing Press, Aligarh, 1986

SEC-1 B : (TITLE OF PAPER) - Stoichiometry-I

Total Credits : 01 (Theory paper)

Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

1. To develop scientific approach among students to inculcate practical awareness
2. To know different concentration units
3. To train for preparing solution of different concentrations
4. Develop proficiency in fundamental chemical laboratory techniques.
5. To develop analytical approach in experimentation
6. Aware error and accuracy experiments

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. understand theoretical aspects and working principles of chemistry labwares,
2. prepare all standards solutions, buffer solutions, indicators, common laboratory reagents,
3. perform the some basic experiments,
4. develop skills in common laboratory techniques,

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Fundamental Concepts of Stoichiometry (15hours) Stoichiometric coefficient, Balancing reactions, Quantitative Information from Balanced Equations, Formula Masses, Chemical Equations, Law of conservation of mass, Avogadro's Number, Mole concept, Chemical calculations and use of molal quantities, Molar volume of gaseous substance, Equivalent Weight, Density and Specific Gravity, Specific Gravity Scales, Composition of Solid, Liquid and Gases, Mass fraction, Mass percentage, Mass ratio, Dry basis and Weight basis, Mole fraction, Mole percent, Volume fraction, Volume percent, Other Expression for Concentration, Significant figure, Precision and Accuracy, Chemical reaction and Process calculations, Excess and Limiting reagent, Conversion, Yield and Selectivity, Extent of reaction.	15 Hrs

Reference books

1. Stoichiometry and Process Calculation by K.V. Narayanan, B Lakshmikutty (Z-lib.org)
2. Stoichiometry Vth edition by B.L. Bhatt and S.B. Thakore
3. Complete Chemistry Guide to Stoichiometry by Mellisaa Maribel

SEC-2 B : (TITLE OF PAPER) - Stoichiometry-I

Total Credits : 01 (Practical paper)

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

1. To develop scientific approach among students to inculcate practical awareness
2. To know different concentration units
3. To train for preparing solution of different concentrations
4. Develop proficiency in fundamental chemical laboratory techniques.
5. To develop analytical approach in experimentation
6. Aware error and accuracy experiments

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. apply working principles of chemistry labwares,
2. prepare all standards solutions, buffer solutions, indicators, common laboratory reagents,
3. perform some basic experiments with accuracy.
4. use skilfully common laboratory techniques,

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Preparation of solutions of different molarity and normality and their standardization (Acid-base, Redox, precipitation and complexometric) Preparation of organic compound based on name reactions starting with 0.05 mole <ol style="list-style-type: none">1. Preparation of 0.1 N solution of oxallic acid and calculate its molarity.2. Preparation of 0.1 N solutions of sulfuric acid and calculate its molarity.3. Prepare a stock solution of 1 M NaOH. Prepare 0.5 M, 0.1 M, 0.01 M, and 0.05 M by dilution method using the stock solution.4. Preparation of 0.1 M and 0.01 M solutions of HCl.5. Prepare a stock solution of 100 ppm KMnO₄. And prepare its 10 ppm and 1 ppm solutions by dilution method.6. Preparation of 1 or 2% w/v solutions of NaOH/ NaCl,7. Preparation of 1 or 2% v/v solutions of Acetic acid, HCl, HNO₃, H₂SO₄.8. Preparation of 0.1 M solutions of ammonia.9. Preparation of a buffer solution of pH= 4.10. Preparation of a buffer solution of pH= 7.11. Preparation of a buffer solution of pH= 9.2	30 Hrs

Reference books

1. Stoichiometry and Process Calculation by K.V. Narayanan, B Lakshmikutty (Z-lib.org)

2. Stoichiometry Vth edition by B.L. Bhatt and S.B. Thakore

3. Complete Chemistry Guide to Stoichiometry by Mellisaa Maribel

Web References :

1. https://en.wikipedia.org/wiki/Laboratory_glassware#:~:text=Laboratory%20glassware%20refers%20to%20a,%2C%20biology%2C%20and%20analytical%20laboratories.
- 2 <https://brilliant.org/wiki/inductive-effect-electromeric-effect-resonance/>
3. <https://sciencing.com/glassware-apparatus-uses-7445911.html>
4. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/Misc/COMMON_LABORATORY_TECHNIQUES
5. <https://www.youtube.com/watch?v=Q47hTaIKvN0&t=871>
6. https://chem.libretexts.org/Ancillary_Materials/Demos_Techniques_and_Experiments/General_Lab_Techniques
7. <https://ucblueash.edu/content/dam/refresh/blueash-62/documents/academics/academic-departments/chemistry/LabSafetyRules.pdf>

This course will be available for the students form other faculty

GE/ OE -1 : (TITLE OF PAPER) Herbal Chemistry - I

Total Credits : 02

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

To aware the importance of herbs for health.
to use appropriate steps to prepare preserve herbal products.
to aware rules and regulations related herbal products

Course Outcomes (COs) :

After completion of the course, students will be able to -

CO1: acquainted with importance of herbal drugs,

CO2: know the different sources of herbal medicine and their preparation

CO3: acquire the knowledge of organic farming

CO4: know about the Indian system of drugs ayurveda, Unani, siddha and homeopathy

CO5: know health benefits and role of nutraceuticals

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	<p>General Introduction to Herbal Industry Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal .and aromatic plants in India.</p> <p>Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs, Selection, identification and authentication of herbal materials Processing of herbal raw material</p>	10 Hrs
II	<p>Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides /Bioinsecticides.</p> <p>Indian Systems of Medicine a) Basic principles involved in .Ayurveda Siddha, Unani and Homeopathy b) Preparation and Standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika. Churna, Lehya and Bhasma.</p>	10 Hrs
III	<p>Nutraceuticals General aspects. Market, growth, cope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like</p>	10 Hrs

<p>Diabetes, CVS diseases Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek. Garlic. Honey, Amla, Ginseng, Ashwagandha. Spirulina Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba. Ginseng. Garlic, Pepper & Ephedra.</p>	
<p><i>Text / Reference Books:</i></p> <ol style="list-style-type: none"> 1. Trease & Evans, Textbook of Pharmacognosy. 2. Tyler. Brady & Robber, Textbook of Pharmacognosy. 3. Kokate, Purohit and Gokhale, Pharmacognosy 4. Dr.S.H.Ansari, Essential of Pharmacognosy 5. V.D.Rangari, Pharmacognosy & Phytochemistry 6. Pharmacopeial standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopath) 7.Mukherjee, P.W. Quality Control of I herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002 	

Semester II

DSC-3 : (Title of Paper) FUNDAMENTALS OF CHEMISTRY-2

Total Credits : 02

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- i) To develop critical thinking about the nature of chemical bonds.
- ii) To understand the concept of hybridization and thereby the geometry of simple molecules.
- iii) To train the students to predict the geometries and shapes of molecules on the basis VBT
- iv) To understand the organic molecules in three dimension
- v) To aware about the isomerism in organic compounds
- vi) To understand the factors affection rate of reactions and order of reactions

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) Identify the type bond
- ii) Predict the shape and geometry and bond angle in a molecule
- iii) Understand the factors affecting ionic bond formation
- iv) Identify types of isomerism
- v) Apply the CIP rules for nomenclature of stereoisomers
- vi) Rate of reactions and factors affecting it
- vii) Solve the numerical on order reactions

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Chemical Bonding and Molecular structure (I) (10 Hrs) a) Ionic Bonding Definition and general characteristics of ionic bonding. Factors affecting on an Ionic bond formation. Lattice energy, salvation energy and their importance. Born Lande equation (no derivation) to calculate lattice energy. Born-Haber cycle for NaCl and its applications Fajan's Rule, Applications of Fajan's rule for, Polarizing power and polarizability, Ionic character in covalent compounds, Dipole moment and percentage ionic character b) Covalent Bonding. Concept of hybridization, different types of hybridization and geometry of following molecules on the basis of Valence bond theory. Linear geometry- BeCl_2 (sp hybridization), Planer trigonal geometry- BF_3 (sp^2 hybridization), Tetrahedral geometry- SiCl_4 (sp^3 hybridization), Trigonal bipyramidal geometry- PCl_5 (sp^3d	10 Hrs

	hybridization), Octahedral geometry- SF ₆ (sp ³ d ² hybridization), Pentagonal bipyramidal geometry -IF ₇ (sp ³ d ³ hybridization)	
II	A) Isomerism and Stereochemistry Concept of isomerism, type, (Structural chain, position, functional group) Representation of organic, Molecules – zig- zag structures, projection formulae – (Saw horse (Andiron), Newman, Fisher & Dotted – wedge). Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Elements of symmetry Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S and E / Z Nomenclature. Conformation : chair and boat form of cyclohexane	10 Hrs
III	Chemical Kinetics Rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction. (Nature of reactant, Concentration, pressure, temperature and catalyst.) Order and Molecularity of reaction, Zero-order reaction, First order reaction, Characteristics of first-order reaction. examples, Pseudo-unimolecular reactions, examples. Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction., Numerical on First order and second order reactions. Arrhenius equation, Concept of energy of activation.	10 Hrs

Text / Reference Books:

Unit I

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry:
5. Principles of Structure and Reactivity, Pearson Education India, 2006.
6. Puri, Sharma, Kalia. Principles of Inorganic Chemistry
7. Madan R. L. Chemistry for Degree Students (B . Sc. First year), S. Chand Publications

Unit II

1. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
4. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
5. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
6. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
7. Stanley Pine, Organic Chemistry, 5th edition.
8. Mukharjee, Singh and Kapoor, Organic Chemistry Vol. I, II and III -Wiley Eastern.
9. S.K. Ghosh, Organic Chemistry.
10. S.M. Mukharjee and S.P. Singh, Reaction Mechanism in Organic Chemistry.

11. P.S. Kalsi, Stereochemistry and mechanism through solved problems.
12. P S Kalsi, Organic reactions and their mechanism , New age.
13. Grossman, Robert B, The Art of Writing Reasonable Organic Reaction Mechanism
14. Raj K Bansal Organic chemistry
15. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000
16. P.S. Kalsi , Text book of Organic Chemistry , Macmillan India Ltd., 1999, Delhi.

Unit III

1. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing House, 44th Edition
2. Gurdeep Raj, Advanced Physical Chemistry GOEL Publishing House, 6th Edition
3. Bahl , Tuli and Bahl, Essentials of Physical Chemistry,
4. Soni and Dharmarha, Text Book of Physical Chemistry,
5. H J Arnikar, Essentials of Nuclear Chemistry, New Age, 4th edition.
6. F. Daniel, Mathematical preparation of Physical Chemistry :,Mc-Graw Hill Book Company Ltd.
7. S. Glasstone and D. Lewis, Elements of Physical Chemistry : (D.Van Nostrand Co.Inc)
8. W. J. Moore, Physical Chemistry : (Orient Longman)
9. Maron Prutton, Principles of Physical Chemistry :
10. B. H. Mahan, University Chemistry: (Addison - Wiseley Publ. Co.)

DSC-4 : (Title of Paper) Lab course-2

Total Credits : 02
Maximum Marks : 50

Total Contact Hours : 60 Hrs

Learning Objectives of the Course:

- i) To train for volumetric technique.
- ii) To give skill for handling the various apparatus and chemicals in preparation and purification
- iii) to train for purification of compounds
- iv) to develop skill to check the purity of the compounds
- v) to provide skill of handling specialized apparatus viscometer, stalagmometer for determining physical properties

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) Acquire skills in common techniques for the Volumetric estimations of inorganic compound
- ii) Acquire skills in common techniques preparation and purification of organic compounds.
- iii) Assess the effectiveness of purification techniques
- iv) Develop precision in measuring and recording physical constants
- v) Analyze the relationship between melting/boiling points and purity.
- vi) Develop skills in recording and reporting experimental procedures and results
- vii) Handle different apparatus like eudiometer viscometer, stalagmometer for determining physical properties

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. 2. Estimation of oxalic acid by titrating it with KMnO_4 . 3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 . 4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator. 5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.	20 Hrs
II	1. Preparation of acetanilide (Acetylation). 2. Preparation of Benzanilide (Benzoylation).	20 Hrs

	<p>3. Preparation of m-di-Nitrobenzene (Nitration).</p> <p>4. Preparation of tri-Bromoaniline from Aniline (Bromination).</p> <p>5. Preparation of Benzoic acid from Benzamide (Hydrolysis).</p> <p>6. Preparation of phenyl-azo – β – naphthol dye (Diazotisation).</p>	
III	<p>1. Study of the solubility of benzoic acid in water and determination of ΔH.</p> <p>2. Determination of Equivalent weight of mg by Eudiometer</p> <p>3. To Determine Viscosity of given liquid (Water / Ethanol) by viscometer.</p> <p>4. To determine surface tension of given liquid by Staganometer.</p> <p>5. Chemical Kinetics: To study the effect of acid strength on the hydrolysis of an ester.</p>	20 Hrs

Text / Reference Books:

- 1) F.G. Mann, B.C. Saunders, Practical Organic Chemistry, Orient Longman.
- 2) V.K. Ahluwalia and Sunita Dhingra, Comparative Practical Organic Chemistry (Qualitative Analysis), Orient Longman.
- 3) V.K. Ahluwalia and Renu Agrawal, Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by, Orient Longman.
- 4) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- 5) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
- 6) Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012
- 7) Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.
- 8) Vogel-A text book of qualitative inorganic analysis.
- 9) O P Pandey, D. N, Practical Chemistry (for B.Sc. I, II and III year students) – Bajpaiand
- 10) Kolthoff and Sandell-Text book of qualitative inorganic analysis
- 11) Ahluwalia, V.K.; Dhingra, S. (2004), Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.
- 12) Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012), Vogel's Textbook of Practical Organic Chemistry, Pearson.
- 13) Leonard, J.; Lygo, B.; Procter, G. Advanced Practical Organic Chemistry, CRC Press.
- 14) Palit and De, Practical Physical Chemistry:.
- 15) Yadav, Practical Physical Chemistry:.
- 16) Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
- 17) Gurdeep Raj, Advanced Practical Inorganic Chemistry, Goel Publishing House, Meerut.
- 18) S. W. Rajbhoj and Dr. T. K. Chondekar, Systematic Practical Physical Chemistry by Prof. Anjali Publication, Aurangabad

1. <https://vlab.amrita.edu/?sub=2>
2. <https://chemcollective.org/vlabs>
3. <https://chem.libretexts.org/>

4. https://en.wikipedia.org/wiki/Laboratory_glassware#:~:text=Laboratory%20glassware%20refers%20to%20a,%2C%20biology%2C%20and%20analytical%20laboratories.
6. <https://brilliant.org/wiki/inductive-effect-electromeric-effect-resonance/>
7. <https://sciencing.com/glassware-apparatus-uses-7445911.html>
8. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/Misc/COMMON_LABORATORY_TECHNIQUES
9. <https://www.youtube.com/watch?v=Q47hTa1KvN0&t=871>
10. https://chem.libretexts.org/Ancillary_Materials/Demos_Techniques_and_Experiments/General_Lab_Techniques
11. <https://ucblucash.edu/content/dam/refresh/blucash-62/documents/academics/academic-departments/chemistry/LabSafetyRules.pdf>

VSC-1 A : (TITLE OF PAPER) - Cosmetics and perfumery

Total Credits : 01 (Theory paper)

Total Contact Hours : 15 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- 1 aware about types of perfumes and their composition
1. Give knowledge about extraction method for perfumes
 2. Aware about different cosmetic products
 3. Impart knowledge about constituents of cosmetic
 4. Give knowledge about essence

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Classify the perfumes
2. Understand the constituent of perfumes
3. Preparation of perfumes
4. Constitutes of cosmetics
5. Method of preparing cosmetics
6. Prepare essence

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	BASICS OF PERFUMES Introduction to perfumes, history, classification of perfumes, the concept of aroma, types and physiological effects. Composition, formulation and working mechanism of perfume. Antiperspirants and deodorants: definition, working mechanism, composition, formulation chemistry and comparison. Introduction to perfumery chemicals: Natural sources, natural identical and synthetic compounds. Extraction methods of perfumery chemicals. Examples of some important perfumery chemicals (synthesis, properties and chemistry) BASICS OF COSMETICS Introduction to cosmetics: Definition, history and application. Cosmetology, Introduction to cosmeceuticals. Anatomy of skin and hair with respective to cosmetology. Classification of cosmetics. Physiological effects of cosmetics. Cosmeceuticals: definition, classification, chemicals, mechanism of action. Chemistry of materials used in cosmeceuticals. Applications of essence in cosmetics and perfumery sector. BASICS OF ESSENCE Definition of Essence, Types of essence, extraction methods of essence, role of essence in skin care products, mechanism of essence in skin care products, applications of essence in perfume and cosmetics.	15 Hrs

Reference books

- 1 Hilda Butler (editor), Dordrecht Poucher's Perfumes, Cosmetics, and Soaps
Kluwer Academic Publishers 2010 Austria
 - 2 D.F. Williams Chemistry and Technology of the Cosmetics and Toiletries Industries
Springer International Edition USA
 - 3 Anthony J. O'Lenick Jr.; Thomas G. O'Lenick Organic chemistry for cosmetic
chemists Allured Publishing 2008 London
 - 4 Schueller and Romanowsk Beginning Cosmetic Chemistry Allured Pub Corp
2009 London
 - 5 Barel AO, Paye M, Maibach Hi Handbook of cosmetic science and technology
CRC Press 2014 USA
- 1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
 - 2) Cosmetics - Formulations, Manufacturing and Quality Control, .P.P. Sharma, 4th Edition,
Vandana Publications Pvt. Ltd., Delhi.
 - 3) Text book of cosmeticology by Sanju Nanda & Roop K, Khar, Tata Publishers.

Web References :

1. <https://youtu.be/e-cLID1Ga5g?si=CGpPhdywIjFM0hMU>
2. <https://youtu.be/V-bWm2FnVk4?si=I0IyHR4lhp0J5T8->
3. <https://youtu.be/gLBLOuDwqKY?si=cQ3D8KrtDQeGh857>
4. <https://youtu.be/3VcdyyC-nsw?si=sfB6NFaNtE6mgI5e>
5. <https://youtu.be/V-bWm2FnVk4?si=RlpP2nMZhCYsu51I>
6. <https://youtu.be/3bgTpf4U8Kk?si=MTYtkMq0N0KAKZ2v>
7. <https://youtu.be/s0I7ZsGqUhk?si=popfpJyB84Zb86PT>
8. https://youtu.be/XD4g_9DKO0g?si=4NwJq374mpqoDE9S

VSC-2 A : (TITLE OF PAPER) - Cosmetics and perfumery

Total Credits : 01 (Practical paper)

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

- 1 aware about types of perfumes and their composition
5. Give knowledge about extraction method for perfumes
6. Aware about different cosmetic products
7. Impart knowledge about constituents of cosmetic
8. Give knowledge about essence

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Classify the perfumes
2. Understand the constituent of perfumes
3. Preparation of perfumes
4. Constitutes of cosmetics
5. Method of preparing cosmetics
6. Prepare essence

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	PREPARATION OF PERFUMES AND COSMETICS Six practicals should be carry out in laboratory Preparation of following using essence and perfumes: Talcum powder. Shampoo. Enamels. Face cream. Nail polish and nail polish remover. Hand wash Hand sanitizer Body lotion Tooth powder Tooth paste	30 Hrs

Reference books

- 1 Hilda Butler (editor), Dordrecht Poucher's Perfumes, Cosmetics, and Soaps
Kluwer Academic Publishers 2010 Austria
- 2 D.F. Williams Chemistry and Technology of the Cosmetics and Toiletries Industries
Springer International Edition USA
- 3 Anthony J. O'Lenick Jr.; Thomas G. O'Lenick Organic chemistry for cosmetic
chemists Allured Publishing 2008 London
- 4 Schueller and Romanowsk Beginning Cosmetic Chemistry Allured Pub Corp

2009 London

5 Barel AO, Paye M, Maibach HI Handbook of cosmetic science and technology CRC Press 2014 USA

4) Harry's Cosmetology, Wilkinson, Moore, Seventh Edition, George Godwin.

5) Cosmetics - Formulations, Manufacturing and Quality Control, .P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.

6) Text book of cosmetology by Sanju Nanda & Roop K, Khar, Tata Publishers.

Web References :

1. <https://youtu.be/e-cLID1Ga5g?si=CGpPhdywIjFM0hMU>
2. <https://youtu.be/V-bWm2FnVk4?si=I0IyHR4lhp0J5T8->
3. <https://youtu.be/gLBLOuDwqKY?si=cQ3D8KrtDQeGh857>
4. <https://youtu.be/3VcdyyC-nsw?si=sfB6NFaNtE6mgI5e>
5. <https://youtu.be/V-bWm2FnVk4?si=RlpP2nMZhCYsu51I>
6. <https://youtu.be/3bgTpf4U8Kk?si=MTYtkMq0N0KAKZ2v>
7. <https://youtu.be/s0I7ZsGqUhk?si=popfpJyB84Zb86PT>
8. https://youtu.be/XD4g_9DKO0g?si=4NwJq374mpqoDE9S

VSC-1 B : (TITLE OF PAPER) - Soap and detergents		
Total Credits : 01 (Theory paper)		Total Contact Hours : 15 Hrs
Maximum Marks : 50		
Learning Objectives of the Course: To aware the different types of cleaning agents To aware different methods used of preparation of soaps detergents and shampoos To know the different parameters for purity of soaps, detergents and shampoos To know the techniques for checking quality and purity of samples		
Course Outcomes (COs) : After completion of the course, students will be able to - CO1: Can gain the information about soaps, detergents and shampoos. CO2: Can Acquire knowledge of basic concepts and techniques of soap and detergent industry. CO3: Get hands training of analysis of soaps and detergents. CO4: Aware about environmental aspects of detergents. CO5: Development Skill for detergent, liquid soap and laundry soap making		
Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Soaps and Detergents Soap -Introduction. Types of soaps - Toilet soaps, washing soaps. Liquid soap. TFM and grades of soaps. Bathing bars. Saponification process, cleansing action of soap. Detergents -Introduction. Types of detergents - anionic, cationic, non-ionic and amphoteric detergents. Common detergent additives. Enzymes used in commercial detergents. Comparison between soaps and detergents. Environmental aspects. Shampoos Manufacture of SLS and SLES. Ingredients. Functions. Different kinds of shampoos – antidandruff, anti-lice, herbal and baby shampoos. Manufacture of conditioners	15 Hrs
Reference books		
<ol style="list-style-type: none"> 1. Handbook on Soaps- Detergents & Acid Slurry 2nd Edition by Niir Board 2. Ajay Kr. Gupta, Handbook on Soaps, Detergents & Acid Slurry , 3rd revised edition; NIIR Board publication. ISBN: 9789381039472 		

3. P. K. Chattopadhyay, Modern Technology of Soaps, Detergents & Toiletries (with Formulae & Project Profiles) 4th Revised Edition, NIIR Board publication; ISBN: 9789381039700
4. H. Panda, Herbal Soaps & Detergents Handbook, NIIR Board publication; ISBN: 978938103900.
5. I. Ash, M. Ash, Formulary of Detergents and other Cleaning Agents, Chemical Publishing, 1999. 3.
6. H. Butler, Poucher's Perfumes, Cosmetics and Soaps, 10th Edn., Springer, 2000)

VSC-2 B : (TITLE OF PAPER) - Soap and detergents

Total Credits : 01 (Practical paper)

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

To aware the different types of cleaning agents

To aware different methods used of preparation of soaps detergents and shampoos

To know the different parameters for purity of soaps, detergents and shampoos

To know the techniques for checking quality and purity of samples

Course Outcomes (COs) :

After completion of the course, students will be able to -

Can gain the information about soaps, detergents and shampoos.

CO2: Can Acquire knowledge of basic concepts and techniques of soap and detergent industry.**CO3:** Get hands training of analysis of soaps and detergents.**CO4:** Aware about environmental aspects of detergents.**CO5:** Development Skill for detergent, liquid soap and laundry soap making

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	i) Determine the pH of shampoos, soaps and detergent. ii) Determination of physico-chemical characteristics of oil and fats iii) Moisture content iv) Acid value v) Iodine value vi) Saponification reaction and Saponification value vii) Synthesis of soap viii) Manufacture of liquid soap ix) Manufacture of laundry soap. x) Determination of free caustic alkali and combined alkali in soap. xi) Estimation of rosin in Soap	30 Hrs

Reference books

1. Handbook on Soaps- Detergents & Acid Slurry 2nd Edition by Niir Board
2. Ajay Kr. Gupta, Handbook on Soaps, Detergents & Acid Slurry , 3rd revised edition; NIIR Board publication. ISBN: 9789381039472

3. P. K. Chattopadhyay, Modern Technology of Soaps, Detergents & Toiletries (with Formulae & Project Profiles) 4th Revised Edition, NIIR Board publication; ISBN: 9789381039700
4. H. Panda, Herbal Soaps & Detergents Handbook, NIIR Board publication; ISBN: 978938103900.
5. I. Ash, M. Ash, Formulary of Detergents and other Cleaning Agents, Chemical Publishing, 1999. 3.
6. H. Butler, Poucher's Perfumes, Cosmetics and Soaps, 10th Edn., Springer, 2000)

This course will be available for the students from other faculty

GE/OE-2 : (Title of Paper) Herbal Chemistry-II

Total Credits : 02

Total Contact Hours : 30 Hrs

Maximum Marks : 50

Learning Objectives of the Course:

To aware the importance of herbs for health.
to use appropriate steps to prepare preserve herbal products.
to aware rules and regulations related herbal products

Course Outcomes (COs) :

After completion of the course, students will be able to -

CO1: acquainted with importance of herbal drugs,

CO2: know the different sources of herbal medicine and their preparation

CO3: acquire the knowledge of organic farming

CO4: know about the Indian system of drugs ayurveda, Unani, siddha and homeopathy

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	<p>Herbal Cosmetics Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colour's, perfumes, protective agents, bleaching agents. antioxidants in products such as skin care. hair care and oral hygiene products.</p> <p>Herbal excipients: Herbal Excipients - Significance of substances of natural origin us excipients - colorants, sweeteners, binders, diluents, viscosity builders. disintegrants, flavors & perfumes.</p>	10 Hrs
II	<p>Herbal formulations: Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes</p> <p>Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs</p>	10 Hrs
III	<p>Patenting and Regulatory requirements of natural products: a) Definition of the terms: Patent, IPR. Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neern.</p> <p>Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs</p>	10 Hrs

Reference Books:

1. Trease & Evans Textbook of Phannacognosy.
2. Tyler. Brady & Robber Textbook of Pharnacognosy .
3. Kokate, Purohit and Gokhale, Pharmacognosy
4. Dr.S.H.Ansari Essential of Pharmacognosy
5. V.D.Rangari Pharmacognosy & Phytochemistry
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopath)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

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